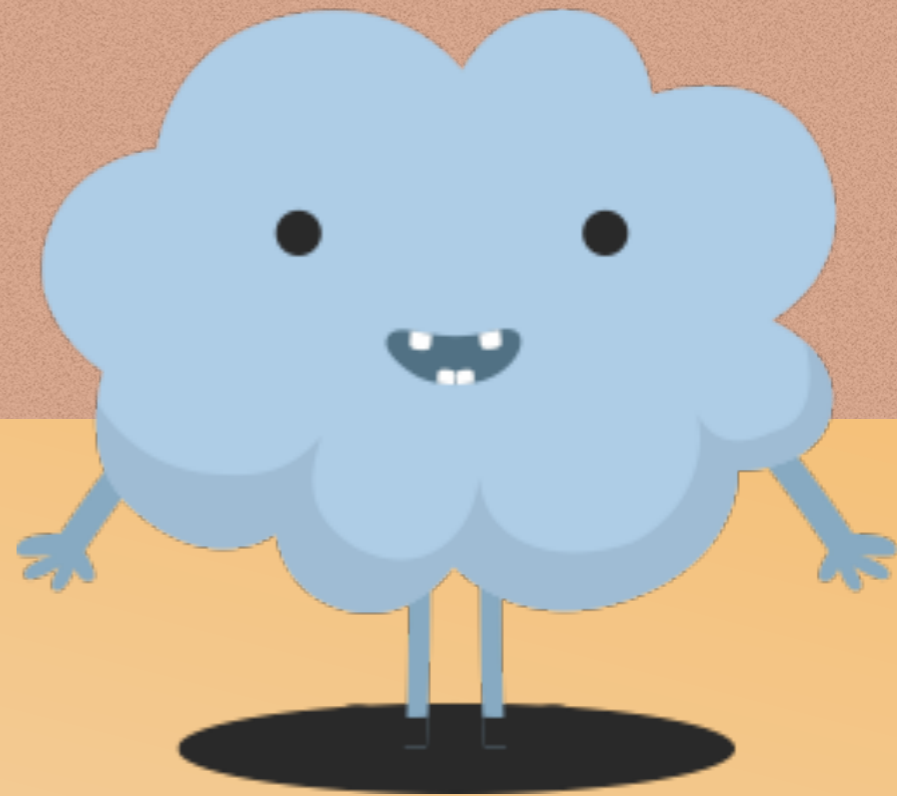


全域觀天儀設計比賽

Total Sky Imager Design Competition



<http://www.cs.hku.hk/~sky/>

Data Processing and Visualisation
數據處理及可視化

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主辦
Organizers



Faculty of Engineering
THE UNIVERSITY OF HONG KONG



香港天文台
HONG KONG OBSERVATORY



香港氣象學會
Hong Kong Meteorological Society

支持單位
Supporting
Organizations



香港電腦教育學會
The Hong Kong Association
for Computer Education

資助
Funding
Support



The University of Hong Kong
Knowledge Exchange

Data Processing and Visualisation

數據處理及可視化

Information is beautiful
資料的美

What to do in the competition? 比賽做甚麼？

- ◆ Familiarise yourselves with the requirements!
<https://i.cs.hku.hk/~sky/Competition-English.php>
熟讀比賽規則及作品要求！
<https://i.cs.hku.hk/~sky/Competition-Chinese.php>
- ◆ Design and implement a total sky imager.
設計及製作全域觀天儀。



Image source: Hong Kong Observatory



Image source: EKO ASI-16 Operator Manual



What to do in the competition?

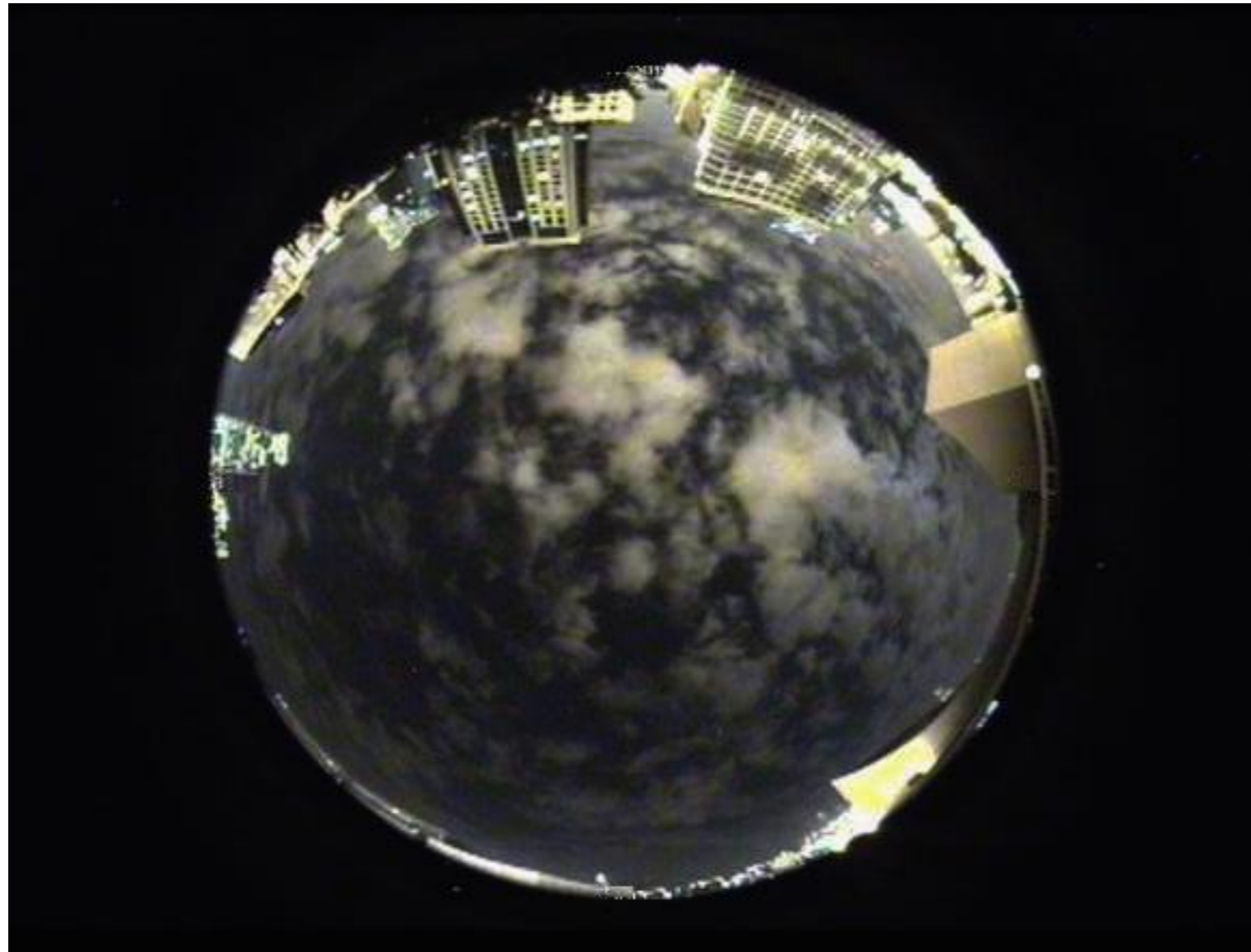
比賽做甚麼？

- ◆ Write report.
寫文字報告。
- ◆ (Primary School teams) Make time-lapse video.
(小學組) 全域影像縮時影片。
- ◆ (Secondary School teams) Store the images and analyse them for cloud cover in Okta.
(中學組) 儲存相片及分析雲量份數。
- ◆ Take Photos of the total sky imager.
拍攝全域觀天儀的作品相片。
- ◆ Make and do presentation.
製作及進行簡報。

Photo two days ago 前天的相片



Let's assume this is the original all sky photo
就當原相是這樣吧



Questions

問題



- ◆ How to generate the panorama view at the top given the fisheye view at the bottom? And the other way round?
如何將魚眼鏡拍的相片變成全景相？反之亦問。
- ◆ How to analyse for the cloud cover?
如何計算雲量？
- ◆ How to visualise the analysis results?
如何以圖表達分析結果？

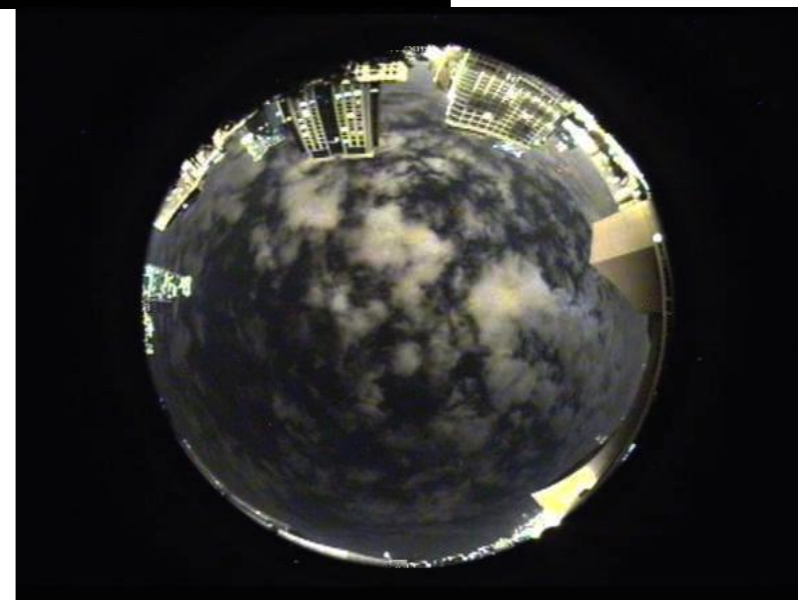
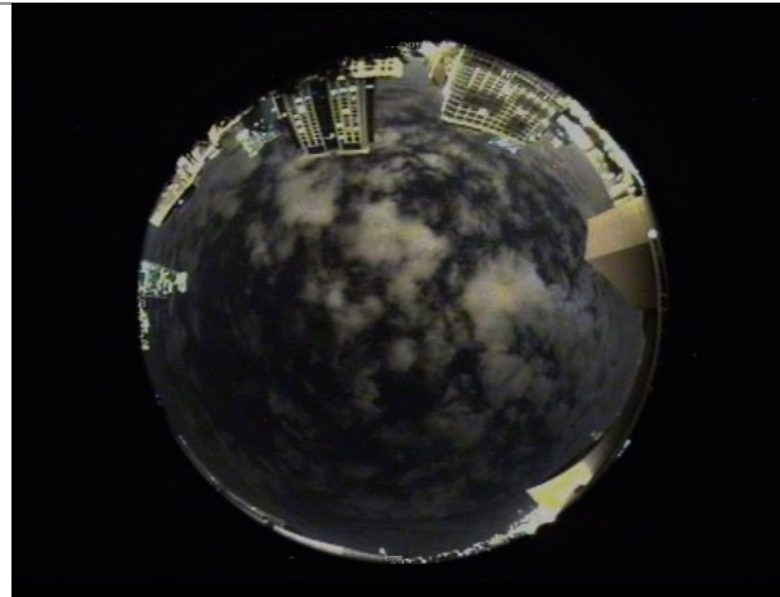
Analysis steps

分析步驟

- ◆ Image preprocessing: noise removal, contrast adjustment, ...
圖像預先處理：去噪、調整對比度……
- ◆ Identify region of interest, like the sky without obstructions.
辨認有用區域，例如沒有被擋的天空。
- ◆ Distinguish between cloud and non-cloud areas.
分辨雲與非雲的區域。
- ◆ Calculate the cloud cover.
計算雲量。

Image preprocessing 圖像預先處理

- ◆ Noise removal
去噪
- ◆ Contrast adjustment
調整對比度



Identify region of interest 辨認有用區域

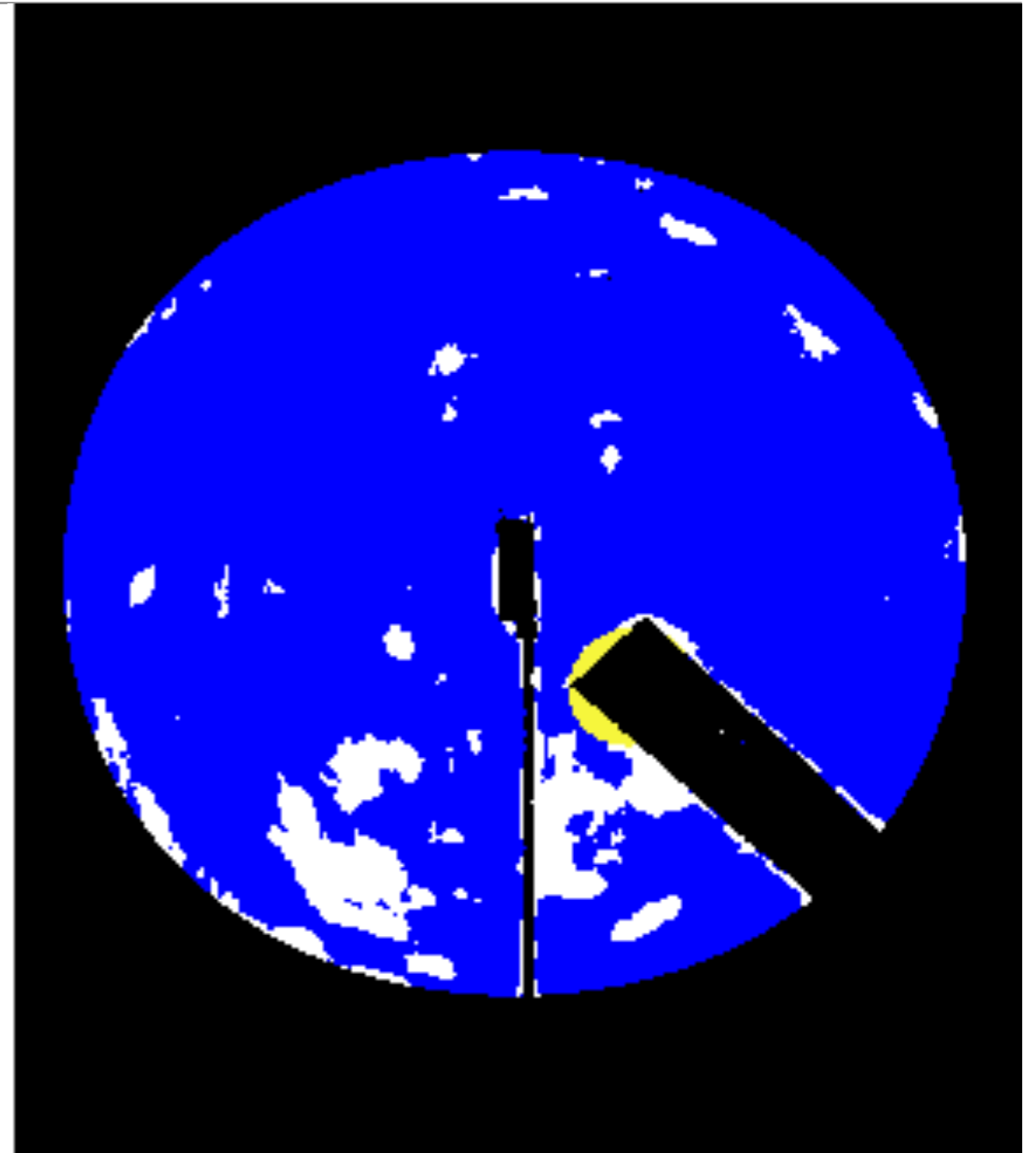
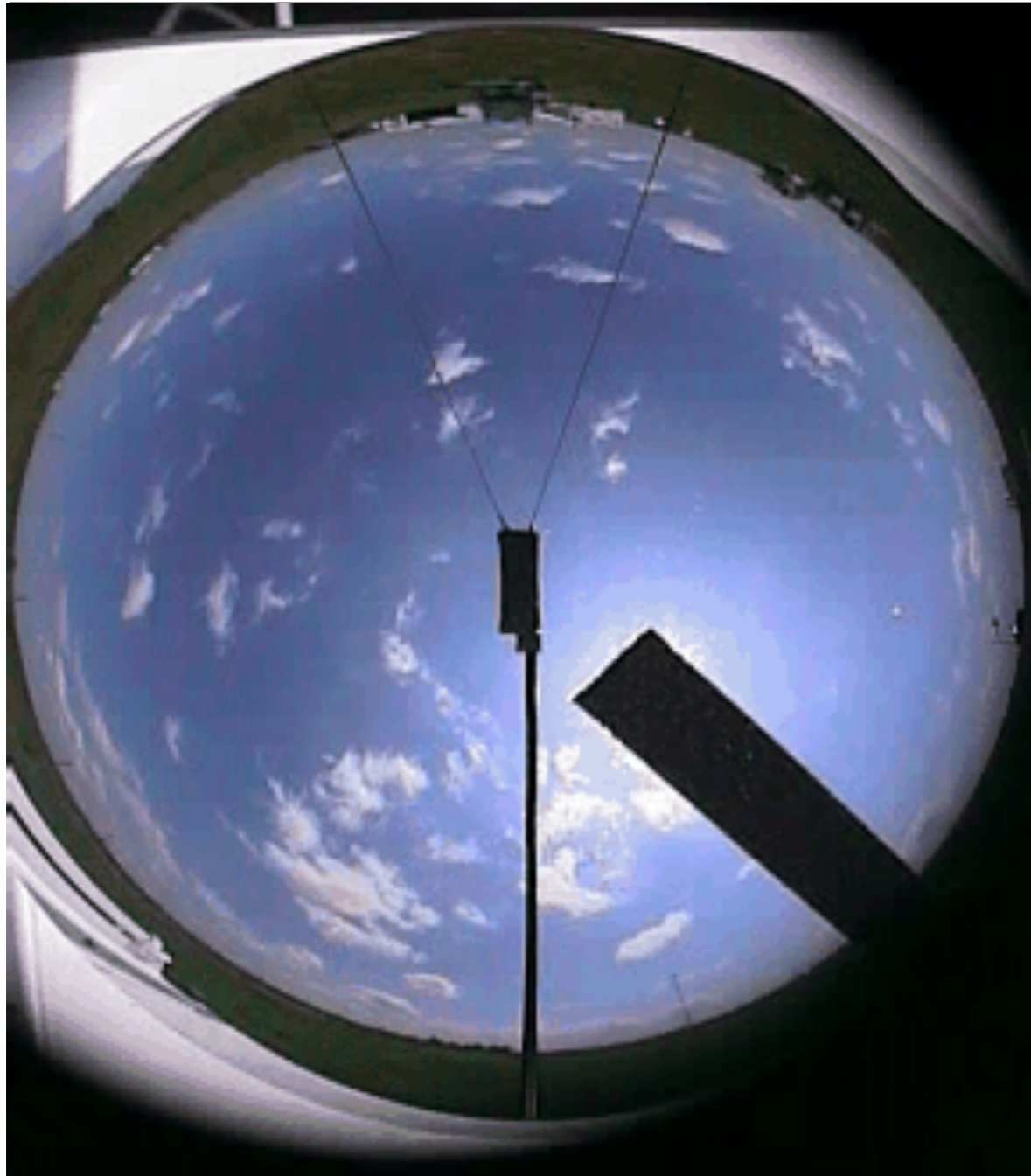


Identify region of interest 辨認有用區域



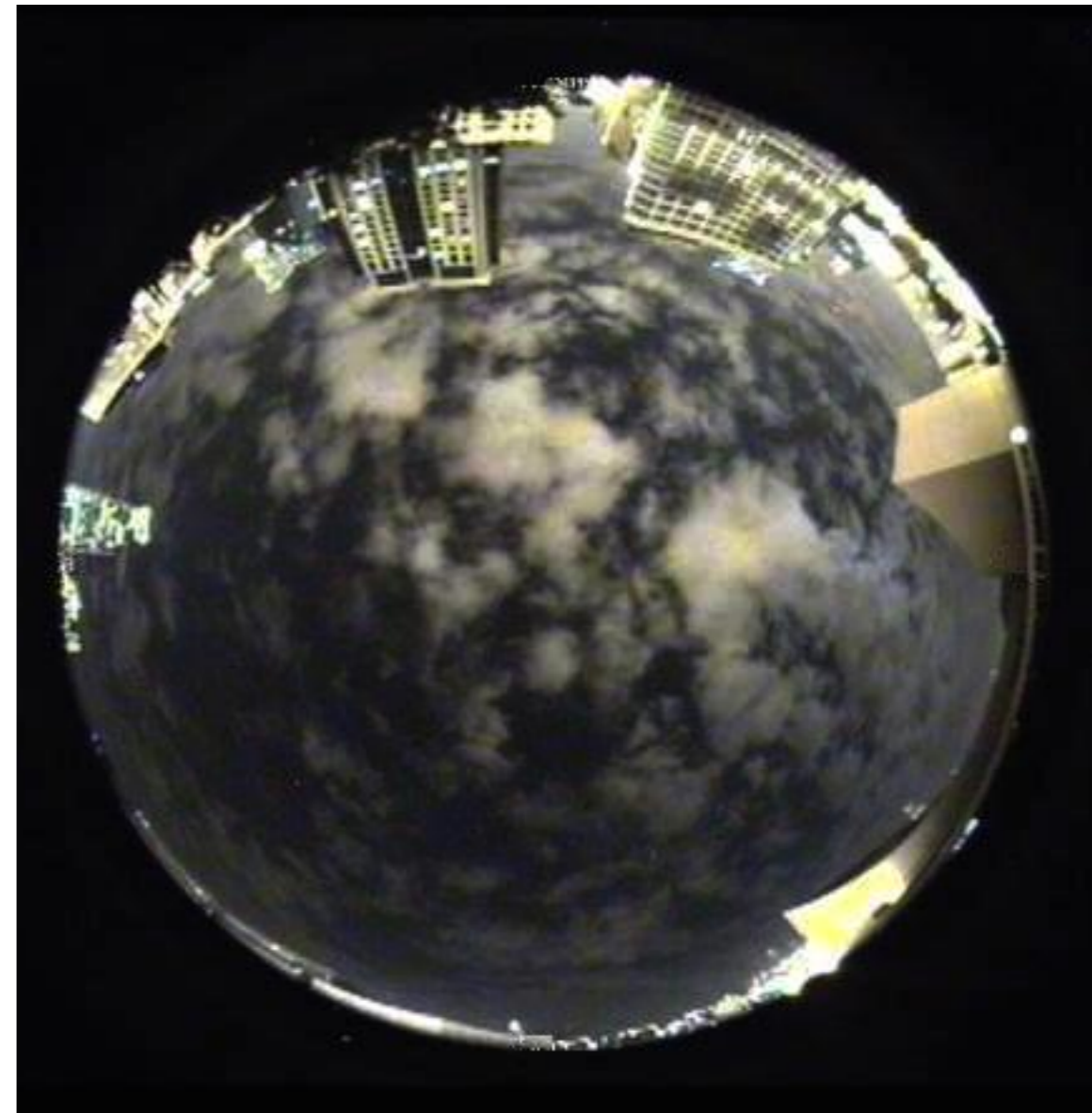
Distinguish between cloud and non-cloud areas

分辨雲與非雲的區域



Calculate the cloud cover 計算雲量

- ◆ Just count the proportion of lighter pixels in the sky?
只計算天空的淺色點的像素就可？
- ◆ Not all pixels are equal!
不是所有像素都是一樣的！
- ◆ Weight the pixels based on the viewing angle.
不同視角的像素權重不同。



Question...

問題……

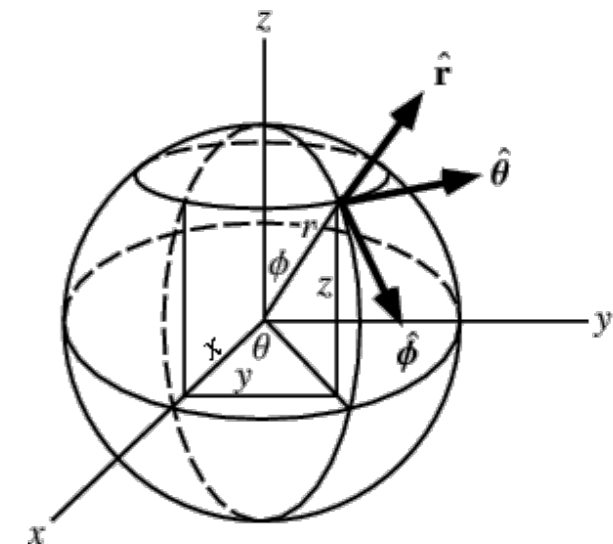


- ◆ Given a point in the fisheye view, what are the azimuth and elevation angles?
如何知道魚眼鏡相片中的一點的方位角和仰角？

- ◆ That requires a bit of maths.
這需要一點數學。

- ◆ Let's learn a bit about spherical coordinate system.
學一點關於球坐標系統的事吧。

<https://mathworld.wolfram.com/SphericalCoordinates.html>



The fisheye perspective 魚眼視角



- ◆ This is about the fisheye perspective.
這是關於魚眼視角的。

<https://mathworld.wolfram.com/FisheyePerspective.html>

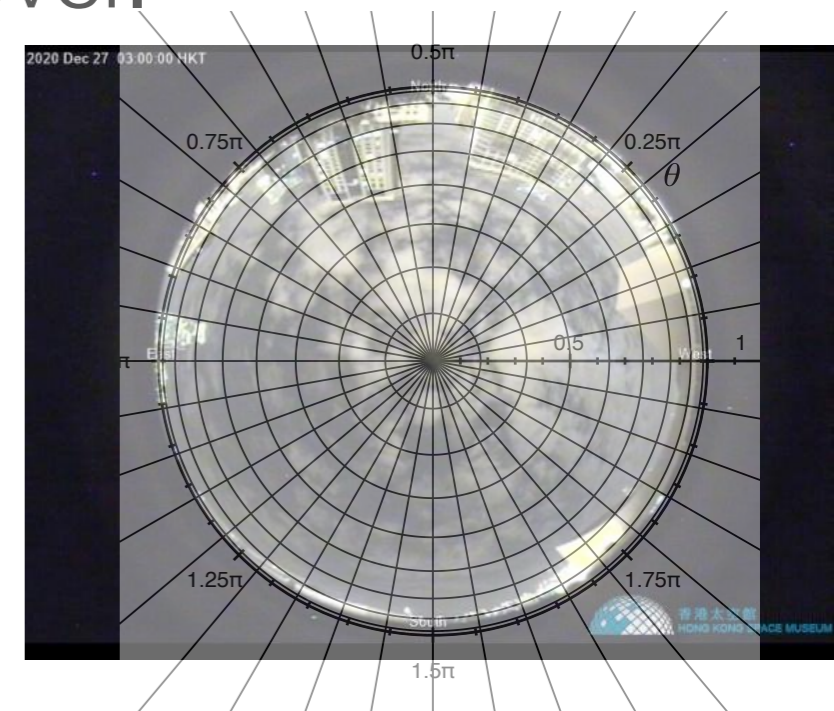
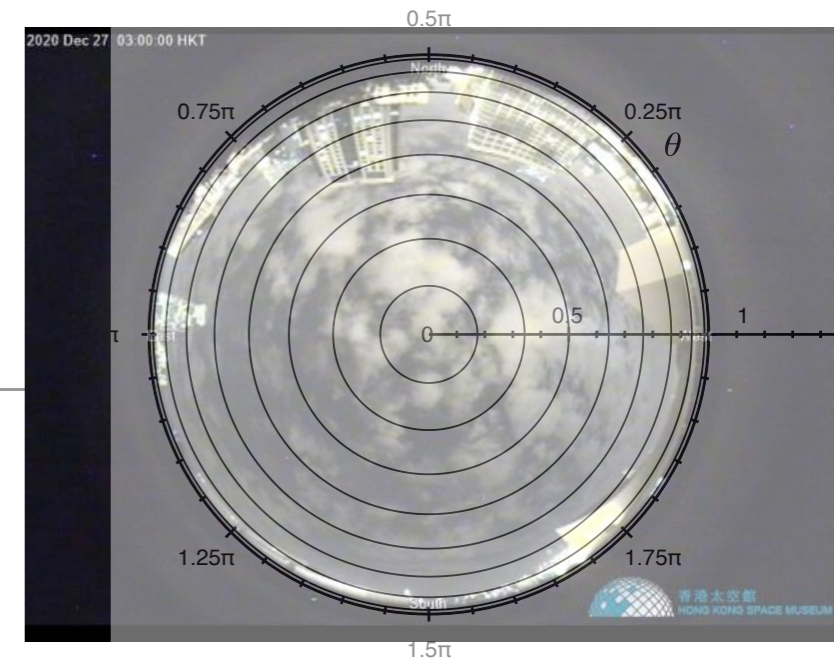
- ◆ This is also informative. Read especially the Additional Notes.
這篇也有很多資料。要讀裏面Additional Notes的連結。

"Converting a fisheye image into a panoramic, spherical or perspective projection". Paul Bourke. July 2016.

<http://www.paulbourke.net/dome/fish2/>

The fisheye perspective 魚眼視角

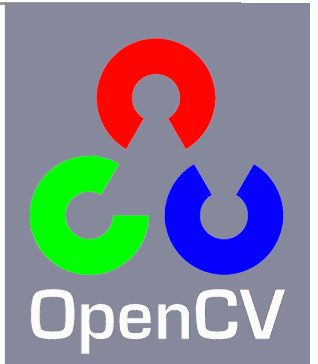
- ◆ When the elevation is small, we can see clouds very far from us.
當仰角低時，我們可以看到很遠的雲。
- ◆ Note that are counting the *local* cloud cover.
注意，我們在計算本地雲量。



Software and tools

軟件和工具

- ◆ OpenCV: image processing library 圖像處理軟件庫
- ◆ Multiple language bindings 多種編程語言可用：
C, C++, Java, Python, Matlab, Octave, JavaScript, C#,
Perl, Haskell, Ruby,...
- * Fisheye camera model.
魚眼相機模式。
[https://docs.opencv.org/4.5.1/db/d58/
group_calib3d_fisheye.html](https://docs.opencv.org/4.5.1/db/d58/group_calib3d_fisheye.html)



Using python for image processing and analysis

利用python來處理及分析影像

- ◆ Python

<https://www.python.org/>



- ◆ Anaconda Individual Edition

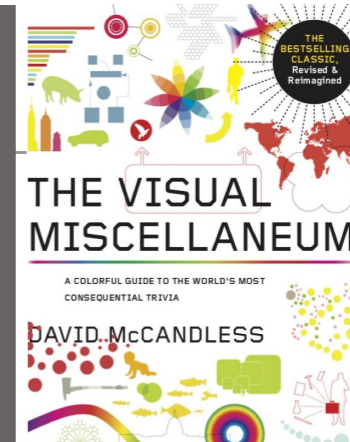
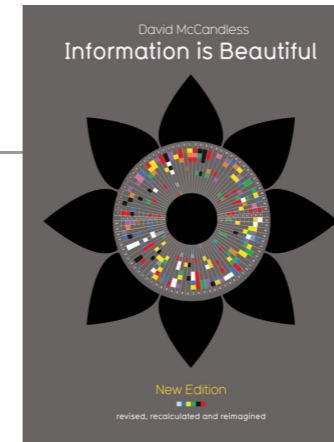
<https://www.anaconda.com/products/individual>



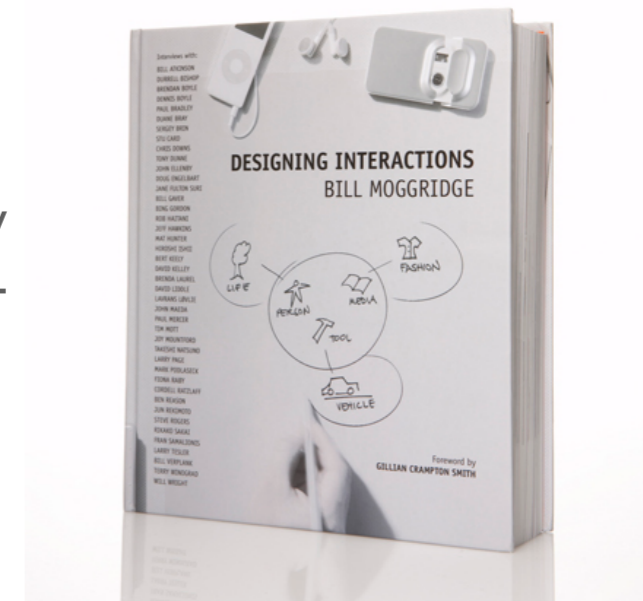
Visualisation 可視化

On design and visualisation 關於設計和可視化

- ◆ Information is Beautiful
<https://informationisbeautiful.net/>



- ◆ Designing Interactions
<https://www.designinginteractions.com/>



Visualisation libraries

可視化軟件庫

- ◆ Data Driven Documents
<https://d3js.org/>



- ◆ matplotlib
<https://matplotlib.org/>



- ◆ seaborn
<https://seaborn.pydata.org/>



- ◆ Bokeh
<https://bokeh.org/>



- * Name comes from Japanese ボケ or 暈け。
名字由日文「ボケ」或「暈け」來。

Nice web pages

好網頁

- ◆ The Many Ways To Call Axes In Matplotlib: A beginner's notes on learning matplotlib.
Jun. 2020-01-17.
<https://towardsdatascience.com/the-many-ways-to-call-axes-in-matplotlib-2667a7b06e06>

Let's write code!
就寫程式吧！

Question-and-answer time

問答時間

